What is claimed is:

- 1. A screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long} , said screen comprising:
 - a substrate having first and second opposing surfaces and a target
 thickness τ;
 - (b) an array of lenses associated with the first surface;
 - (c) a layer of light-absorbing material associated with the second surface, said layer of light-absorbing material comprising a plurality of apertures formed by a process which comprises passing aperture-forming illumination through the array of lenses, said layer having an overall area and an area that is light blocking;

wherein τ has a value such that:

- (i) the apertures do not substantially block light at λ_{long} ; and
- (ii) the ratio ρ of the area that is light blocking to the overall area exceeds 0.5.
- 2. The screen of Claim 1 wherein the array of lenses is an array of randomized lenses.
- 3. The screen of Claim 1 wherein the array of lenses is an array of microlenses.
- 4. The screen of Claim 3 wherein the array of lenses is an array of randomized microlenses.
- 5. The screen of Claim 1 wherein the array of lenses is an array of anamorphic microlenses.
- 6. The screen of Claim 5 wherein the array of lenses is an array of randomized anamorphic microlenses.
- 7. The screen of Claim 5 or 6 wherein: (i) for the aperture-forming illumination, the array of anamorphic microlenses defines an aperture-forming focal plane; and (ii) τ has a value such that the layer of light-absorbing material substantially lies at said focal plane.
- 8. The screen of Claim 7 wherein the anamorphic microlenses have fast axes and slow axes and the aperture-forming focal plane corresponds to the fast axes.
- 9. The screen of Claim 7 wherein the anamorphic microlenses have fast axes and slow axes and the aperture-forming focal plane corresponds to the slow axes.

- 10. The screen of Claim 5 or 6 wherein the anamorphic microlenses have fast axes and slow axes and unequal diameters along said fast and slow axes.
- 11. The screen of Claim 10 wherein D_f is a fast axis diameter and D_s is a slow axis diameter and $D_f > D_s$.
- 12. The screen of Claim 1 or 2 wherein: (i) the lenses are characterized by a thinlens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{\rm exp}} + \frac{1}{f_{\rm max}} \, .$$

13. The screen of Claim 1 or 2 wherein: (i) the lenses are characterized by a thinlens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{\rm exp} + \Delta f_{\rm exp}} + \frac{1}{f_{\rm max} + \Delta f_{\rm max}},$$

where Δf_{exp} and Δf_{max} are respectively variations in f_{exp} and f_{max} due to the lenses having finite thicknesses.

14. The screen of Claim 1 or 2 wherein: (i) the lenses are characterized by a thinlens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) τ substantially satisfies the relationship:

$$2\frac{f_{\exp}f_{\max}}{f_{\exp} + f_{\max}} \le \tau < f_{\exp}\left(1 + \frac{1}{\sqrt{2}}\right).$$

15. The screen of Claim 14 wherein ρ substantially satisfies the relationship:

$$\frac{1}{2} < \rho \le \frac{4f_{\exp}f_{\max}}{\left(f_{\exp} + f_{\max}\right)^2}.$$

16. The screen of Claim 3, 4, 5, or 6 wherein: (i) the microlenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{\rm exp}} + \frac{1}{f_{\rm max}} \,.$$

17. The screen of Claim 3, 4, 5, or 6 wherein: (i) the microlenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) τ substantially satisfies the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{\rm exp} + \Delta f_{\rm exp}} + \frac{1}{f_{\rm max} + \Delta f_{\rm max}},$$

where Δf_{exp} and Δf_{max} are respectively variations in f_{exp} and f_{max} due to the microlenses having finite thicknesses.

18. The screen of Claim 3, 4, 5, or 6 wherein: (i) the microlenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) τ substantially satisfies the relationship:

$$2\frac{f_{\rm exp}f_{\rm max}}{f_{\rm exp}+f_{\rm max}} \le \tau < f_{\rm exp}\left(1+\frac{1}{\sqrt{2}}\right).$$

19. The screen of Claim 18 wherein ρ substantially satisfies the relationship:

$$\frac{1}{2} < \rho \le \frac{4f_{\rm exp}f_{\rm max}}{\left(f_{\rm exp} + f_{\rm max}\right)^2}.$$

20. The screen of Claim 1 wherein in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \frac{x^2}{2R_{eq}} + \sum_{k=2}^{\infty} c_{2k} x^{2k} ,$$

where R_{eq} is an equivalent radius of curvature and the c_{2k} 's are coefficients of higher-order terms.

21. The screen of Claim 20 wherein R_{eq} and τ substantially satisfy a relationship of the form:

$$R_{eq} = \left(1 - \frac{1}{2n_{\rm exp}} - \frac{1}{2n_{\rm max}}\right)\tau ,$$

where n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long} , respectively.

22. The screen of Claim 1 wherein in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \alpha \left(R_s - \sqrt{R_s^2 - x^2}\right) + \frac{x^2}{2R_p},$$

where R_s is a spherical radius of curvature, R_p is a parabolic radius of curvature, and α is a scale factor.

- 23. The screen of Claim 22 wherein at least one of R_s , R_p , and α is randomized.
- 24. The screen of Claim 23 wherein at least one of R_s , R_p , and α is not randomized and is selected to substantially satisfy a relationship of the form:

$$\frac{R_p R_s}{\alpha R_p + R_s} = \left(1 - \frac{1}{2n_{\rm exp}} - \frac{1}{2n_{\rm max}}\right) \tau ,$$

where n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long} , respectively.

25. The screen of Claim 1 wherein the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y) = \frac{\alpha_x x^2 / R_{sx} + \alpha_y y^2 / R_{sy}}{1 + \sqrt{1 - x^2 / R_{sx}^2 - y^2 / R_{sy}^2}} + \frac{x^2}{2R_{px}} + \frac{y^2}{2R_{py}},$$

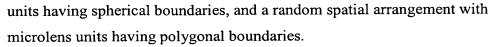
where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors.

- 26. The screen of Claim 25 wherein at least one of R_{sx} , R_{sy} , R_{px} , R_{py} , α_x , and α_y is randomized.
- The screen of Claim 1 wherein the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y) = \alpha_x \left(R_{sx} - \sqrt{R_{sx}^2 - x^2} \right) + \frac{x^2}{2R_{px}} + \alpha_y \left(R_{sy} - \sqrt{R_{sy}^2 - y^2} \right) + \frac{y^2}{2R_{px}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors.

- 28. The screen of Claim 27 wherein at least one of R_{sx} , R_{sy} , R_{px} , R_{py} , α_x , and α_y is randomized.
- 29. The screen of Claim 3, 4, 5, or 6 wherein the array is selected from the group consisting of a close-packed square array, a close-packed rectangular array, a close-packed hexagonal array with microlens

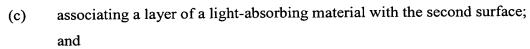


- 30. The screen of Claim 3, 4, 5, or 6 wherein the shape of the apertures is selected from the group consisting of horizontally-modulated lines, vertically modulated lines, horizontal ovals, horizontal ovals in a hexagonal spatial arrangement, horizontal ovals in a square spatial arrangement, vertical ovals, vertical ovals in a hexagonal spatial arrangement, vertical ovals in a square spatial arrangement, horizontal ovals of varying sizes, horizontal ovals of varying sizes in a randomized spatial arrangement, vertical ovals of varying sizes, and vertical ovals of varying sizes in a randomized spatial arrangement.
- 31. The screen of Claim 1 wherein ρ is at least 0.7.
- 32. The screen of Claim 1 wherein the screen has a transmission efficiency which is greater than 80%.
- 33. The screen of Claim 1 wherein a space exists between at least two of the lenses that is randomly interpolated.
- 34. The screen of Claim 1 wherein the array of lenses is an array of microlenses and wherein the microlenses have different diameters along two perpendicular directions.
- 35. The screen of Claim 1 wherein λ_{long} is approximately 700 nm.
- 36. The screen of Claim 1 wherein the array of lenses and the substrate constitute separate components.
- 37. The screen of Claim 1 wherein the array of lenses and the substrate constitute a single unitary component.
- 38. A screen comprising a layer of light-absorbing material which comprises a plurality of apertures, said apertures having a shape selected from the group consisting of horizontally-modulated lines, vertically modulated lines, horizontal ovals, horizontal ovals in a hexagonal spatial arrangement, horizontal ovals in a square spatial arrangement, vertical ovals, vertical ovals in a hexagonal spatial arrangement, vertical ovals in a square spatial arrangement, horizontal ovals of varying sizes, horizontal ovals of varying sizes in a randomized spatial arrangement, vertical ovals of varying sizes, and vertical ovals of varying sizes in a randomized spatial arrangement.

- 39. A screen comprising a substrate and an array of lenses associated with the substrate wherein a space exists between at least two of the lenses that is randomly interpolated.
- 40. A method for producing a screen for use with image-forming illumination, said method comprising:
 - (a) providing a substrate having first and second opposing surfaces;
 - (b) associating an array of anamorphic microlenses with the first surface;
 - (c) associating a layer of a light-absorbing material with the second surface; and
 - (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of microlenses;

wherein the optical properties of the microlenses and a target thickness for the substrate are selected so as to maximize the light-blocking area of the layer of light-absorbing material while allowing image-forming illumination to pass through the layer's apertures substantially unimpeded.

- 41. The method of Claim 40 wherein the array of anamorphic microlenses is an array of randomized anamorphic microlenses.
- 42. The method of Claim 40 or 41 wherein the anamorphic microlenses have fast axes and slow axes.
- 43. The method of Claim 42 wherein in step (d), the fast axes are used to form the apertures.
- 44. The method of Claim 42 wherein in step (d), the slow axes are used to form the apertures.
- 45. The method of Claim 42 wherein the anamorphic microlenses have unequal diameters along said fast and slow axes.
- 46. The method of Claim 45 wherein D_f is a fast axis diameter and D_s is a slow axis diameter and $D_f > D_s$.
- 47. A method for producing a screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long} , said method comprising:
 - (a) providing a substrate having first and second opposing surfaces;
 - (b) associating an array of lenses with the first surface;



(d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses; wherein (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) the substrate has a target thickness τ which is selected using the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{\rm exp}} + \frac{1}{f_{\rm max}}.$$

48. A method for producing a screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long} , said method comprising:

- (a) providing a substrate having first and second opposing surfaces;
- (b) associating an array of lenses with the first surface;
- (c) associating a layer of a light-absorbing material with the second surface; and
- (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses; wherein (i) the lenses are characterized by a thin-lens paraxial focal length f_{exp} associated with the aperture-forming illumination and a thin-lens paraxial focal length f_{max} associated with λ_{long} ; and (ii) the substrate has a target thickness τ which is selected using the relationship:

$$\frac{2}{\tau} = \frac{1}{f_{\text{exp}} + \Delta f_{\text{exp}}} + \frac{1}{f_{\text{max}} + \Delta f_{\text{max}}},$$

where Δf_{exp} and Δf_{max} are respectively variations in f_{exp} and f_{max} due to the lenses having finite thicknesses.

49. A method for producing a screen for use with image-forming illumination which has a longest image-forming wavelength λ_{long} , said method comprising:

- (a) providing a substrate having first and second opposing surfaces;
- (b) associating an array of lenses with the first surface;
- (c) associating a layer of a light-absorbing material with the second surface; and

- (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses; wherein:
 - (i) in at least one direction (the x-direction), the lenses have a sag s(x) which substantially satisfies the relationship:

$$s(x) = \frac{x^2}{2R_{eq}} + \sum_{k=2}^{\infty} c_{2k} x^{2k}$$
,

where R_{eq} is an equivalent radius of curvature and the c_{2k} 's are coefficients of higher-order terms; and

(ii) the substrate has a target thickness τ which is selected using the relationship:

$$R_{eq} = \left(1 - \frac{1}{2n_{\text{exp}}} - \frac{1}{2n_{\text{max}}}\right)\tau,$$

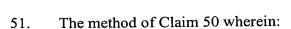
where n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long} , respectively.

- 50. A method for producing a screen comprising:
 - (a) providing a substrate having first and second opposing surfaces;
 - (b) associating an array of lenses with the first surface;
 - (c) associating a layer of a light-absorbing material with the second surface; and
 - (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses; wherein:
 - (i) in at least one direction (the x-direction), the lenses have a sags(x) which substantially satisfies the relationship:

$$s(x) = \alpha \left(R_s - \sqrt{R_s^2 - x^2}\right) + \frac{x^2}{2R_p},$$

where R_s is a spherical radius of curvature, R_p is a parabolic radius of curvature, and α is a scale factor; and

(ii) at least one of R_s , R_p , and α is randomized.



- (i) the screen is for use with image-forming illumination which has a longest image-forming wavelength λ_{long} ; and
- (ii) at least one of R_s , R_p , and α is not randomized and is selected using a relationship of the form:

$$\frac{R_p R_s}{\alpha R_p + R_s} = \left(1 - \frac{1}{2n_{\text{exp}}} - \frac{1}{2n_{\text{max}}}\right)^{\text{T}},$$

where τ is a target thickness of the substrate and n_{exp} and n_{max} are indices of refraction of the lenses associated with the aperture-forming illumination and with λ_{long} , respectively.

- 52. A method for producing a screen comprising:
 - (a) providing a substrate having first and second opposing surfaces;
 - (b) associating an array of lenses with the first surface;
 - (c) associating a layer of a light-absorbing material with the second surface; and
 - (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses; wherein:
 - (i) the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x,y) = \frac{\alpha_x x^2 / R_{sx} + \alpha_y y^2 / R_{sy}}{1 + \sqrt{1 - x^2 / R_{sx}^2 - y^2 / R_{sy}^2}} + \frac{x^2}{2R_{px}} + \frac{y^2}{2R_{py}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors; and

- (ii) at least one of R_{sx} , R_{sy} , R_{px} , R_{py} , α_x , and α_y is randomized.
- 53. A method for producing a screen comprising:
 - (a) providing a substrate having first and second opposing surfaces;
 - (b) associating an array of lenses with the first surface;
 - (c) associating a layer of a light-absorbing material with the second surface; and
 - (d) forming a plurality of apertures in the layer of light-absorbing material by passing aperture-forming illumination through the array of lenses;



(i) the lenses have a sag s(x,y) which substantially satisfies the relationship:

$$s(x, y) = \alpha_x \left(R_{sx} - \sqrt{R_{sx}^2 - x^2} \right) + \frac{x^2}{2R_{px}} + \alpha_y \left(R_{sy} - \sqrt{R_{sy}^2 - y^2} \right) + \frac{y^2}{2R_{px}},$$

where R_{sx} and R_{sy} are spherical radii of curvature, R_{px} and R_{py} are parabolic radii of curvature, and α_x and α_y are scale factors; and

(ii) at least one of R_{sx} , R_{sy} , R_{px} , R_{py} , α_x , and α_y is randomized.